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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole # 50-12-10

Borehole Information

Farm :	T	**Tank :**	T-112	**Site Number :**	299-W10-141
N-Coord :	43,360	**W-Coord :**	75,888	**TOC Elevation :**	671.63
Water Level, ft :	118.80	**Date Drilled :**	3/31/1974		

Casing Record

Type :	Steel-welded	Thickness, in. :	0.280	ID, in. :	6
Top Depth, ft. :	0	Bottom Depth, ft. :	119		
Type :	Steel-welded	Thickness, in. :	0.250	ID, in. :	4
Top Depth, ft. :	0	Bottom Depth, ft. :	119		

Cement Bottom, ft. : 119 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 50-12-10 was drilled in March 1974 to a depth of 94 ft. A 6-in. casing was installed from the ground surface to total depth. In February 1977, the borehole was deepened to 121 ft. Field observations indicate concentric 4-in. and 6-in. casings at the ground surface with grout in the annular space. It is inferred that the 6-in. casing was driven to 121 ft, the 4-in. casing was installed, and the annular space was grouted. The casing wall thickness is assumed to be 0.237 in. for the 4-in. casing and 0.280 in. for the 6-in. casing.

The tops of both casings are approximately even with the ground surface. The top of casing, which is the zero reference for the SGLS, is at an elevation of 671.63 ft.

Equipment Information

Logging System :	2B	**Detector Type :**	HPGe	**Detector Efficiency:**	35.0 %
Calibration Date :	10/1997	**Calibration Reference :**	GJO-HAN-14	**Logging Procedure :**	MAC-VZCP 1.7.10-1

Logging Information

Log Run Number :	1	**Log Run Date :**	12/11/1997	**Logging Engineer:**	Gary Lekvold
Start Depth, ft.:	0.0	**Counting Time, sec.:**	200	**L/R :** L **Shield :**	N
Finish Depth, ft. :	43.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	12/12/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	119.0	**Counting Time, sec.:**	200	**L/R :** L **Shield :**	N
Finish Depth, ft. :	64.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Run Number :	3	**Log Run Date :**	12/15/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	42.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	65.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	12/15/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	95.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	80.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

The borehole was logged in three runs on December 11, 12, and 15, 1997. A repeat section from 80 to 95 ft was logged on December 15, 1997. The maximum logging depth achieved by the SGLS was 119 ft. Spectra were collected at intervals of 0.5 ft, using a 200-s count time for each interval.

The interval between 80 and 95 ft was relogged as an additional quality check and to demonstrate the repeatability of radionuclide concentration measurements made by the SGLS.

At the time of logging, there was no water in the hole.

Analysis Information

Analyst : R.G. McCain

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 05/14/1998

Analysis Notes :

The pre-survey and post-survey field verification measurements met acceptance criteria established for peak shape and system efficiency. Energy and resolution calibrations from appropriate verification spectra were used to establish the channel-to-energy conversion and peak resolution parameters used in processing the spectra acquired during the logging operation.

Peak spreading associated with the relatively thick double casing and annular grout was encountered, and many lines associated with naturally occurring radionuclides were poorly defined. Also, the peak recognition software frequently indicated false peaks in the tails of significant peaks, particularly the K-40 peak at 1460.8 keV, the 1764.5-keV peak associated with the U-238 decay chain, and the 2614.6-keV peak associated with the Th-232 decay chain. These peaks were manually deleted.

A casing correction factor for 0.50-in.-thick steel casing was used to determine concentration data over the entire depth. This factor most closely matches the combined thickness of the 4-in. and 6-in. casings. Concentrations are lower than actual because there is no allowance for the effects of the annular grout between casings. Shape factor analysis was not performed because there was little indication of man-made radionuclides and because the effects of the dual casing and annular grout on the shape factors are not well understood.

A comparison of the measured concentrations of the naturally occurring radionuclides detected in the original

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and repeated logging runs indicates that the measurements generally repeat within two standard deviations (95-percent confidence level), indicating excellent repeatability. No man-made radionuclides were detected in the relogged interval.

Log Plot Notes:

Separate plots show the man-made and naturally occurring radionuclides. Concentrations are shown as apparent concentrations to reflect the uncertainty associated with the dual casing and annular grout. The headings of the plots identify the specific gamma lines used to calculate concentrations. Uncertainty bars in the plots show statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plot indicate the MDL, which represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

The combination plot includes man-made and natural radionuclides, the total gamma count rate derived from the spectral data, and the latest available Tank Farms gross gamma log. No attempt has been made to adjust the depths of the historical tank farm gross gamma logs to coincide with the SGLS data.

A comparison plot of the naturally occurring radionuclides detected during the original and repeated logging runs is also included.

Results/Interpretations:

The only man-made radionuclide detected in this borehole was Cs-137. Cs-137 contamination was detected only at the ground surface at an apparent concentration of 0.2 pCi/g.

K-40 concentrations range from about 8 to 10 pCi/g from the ground surface to about 39 ft and then increase slightly to about 12 to 14 pCi/g. This increase in K-40 concentrations is probably caused by a change from backfill material above this depth to the undisturbed Hanford formation sediments below this depth.

K-40 concentrations decrease to about 10 pCi/g below about 52 ft. This concentration decrease is probably caused by an increase in coarser grained material below this depth. Concentrations increase to about 12 to 14 pCi/g at 82 ft and then decrease to about 5 pCi/g at 94 ft. The concentration increase at 82 ft is probably from increasing silt content. The driller's log records a change from sand to silt at about this depth. The concentration decrease at 94 ft appears to be associated with a caliche layer encountered at that depth. From 94 to 107 ft, the K-40 concentrations vary between about 3 and 8 pCi/g, with higher values probably associated with interbedded silt. From 107 to 119 ft, the K-40 concentrations gradually increase to about 14 pCi/g.

U-238 and Th-232 concentrations fluctuate about 0.5 pCi/g over most of the borehole. There is a slight increase to about 0.9 pCi/g between about 82 and 94 ft, which appears to be associated with a silt layer. Both U-238 and Th-232 increase to slightly over 1 pCi/g at 93 ft. In the remainder of the borehole, the U-238 contamination varies from 0.6 to 1.0 pCi/g and Th-232 varies from 0.2 to 1.0 pCi/g. At about 104 ft, the U-238 concentrations reach a maximum of about 1.4 pCi/g.

The SGLS total gamma-ray plot reflects the changes in KUT concentrations detected throughout the logged interval.